Linear Algebra Quiz Answer Key PDF

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Which operation is not defined for vectors?

A. Addition
B. Scalar multiplication
C. Division ✓
D. Dot product

Which of the following matrices is an identity matrix?

A. \(\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}\) ✓
B. \(\begin{matrix} 0 & 1 \\ 1 & 0 \end{matrix}\)
C. \(\begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix}\)
D. \(\begin{matrix} 0 & 0 \\ 0 & 0 \end{matrix}\)

What is the rank of a zero matrix?

A. 0 ✓
B. 1
C. Depends on the size of the matrix
D. Infinity

Explain how linear algebra is utilized in machine learning algorithms.

Linear algebra is utilized in machine learning algorithms through the use of vectors and matrices to represent data, perform operations like matrix multiplication for transformations, and apply techniques such as Singular Value Decomposition (SVD) for dimensionality reduction.

What are the conditions under which a matrix is invertible?

A matrix is invertible if it is square and its determinant is non-zero.

Explain the significance of the rank-nullity theorem in linear algebra.

The rank-nullity theorem states that for any linear transformation from a finite-dimensional vector space V to a vector space W, the dimension of V (dim V) is equal to the rank of the transformation (dim of the image) plus the nullity of the transformation (dim of the kernel), expressed as: dim V = rank + nullity.

Which of the following is a necessary condition for a matrix to be invertible?

A. It must be a square matrix. ✓
B. It must be a diagonal matrix.
C. It must be a symmetric matrix.
D. It must be a zero matrix.

Describe the process of the Gram-Schmidt orthogonalization and its purpose.

The Gram-Schmidt orthogonalization process involves taking a set of linearly independent vectors and systematically constructing an orthogonal set from them. This is done by iteratively subtractively projecting each vector onto the previously constructed orthogonal vectors, ensuring that the resulting vectors are orthogonal to each other.

Which of the following are true about eigenvectors?

A. They are always non-zero. ✓
B. They can be scaled by any non-zero scalar. ✓
C. They are orthogonal to each other.
D. They correspond to eigenvalues. ✓

Which matrices are diagonalizable?

A. Identity matrix ✓
B. Zero matrix ✓
C. Any square matrix
D. Symmetric matrix ✓

Which of the following are applications of linear algebra?

A. Computer graphics ✓
B. Quantum mechanics ✓
C. Financial modeling ✓
D. Language processing ✓

How do eigenvalues and eigenvectors contribute to understanding the stability of a system?

Eigenvalues with negative real parts indicate stability, while positive real parts indicate instability.

Discuss the role of linear transformations in computer graphics.

Linear transformations play a crucial role in computer graphics by providing a mathematical framework for transforming geometric objects in a consistent and efficient manner, facilitating operations like scaling, rotation, and translation.

What is the eigenvalue of the identity matrix of size 3x3?

A. 0
B. 1 ✓
C. 2
D. 3

What is the determinant of the matrix \(\begin{matrix} 3 & 4 \\ 2 & 1 \end{matrix}\)?

A. -5 ✓
B. 5
C. 10
D. -10

What is the dimension of a vector space defined by the set of all 2x2 matrices?

A. 2
B. 3
C. 4 ✓

D. 5

Which of the following are properties of a vector space?

A. Closure under addition ✓
B. Closure under scalar multiplication ✓
C. Existence of a zero vector ✓
D. Existence of a multiplicative inverse

Which of the following statements are true about orthogonal matrices?

A. Their transpose is equal to their inverse. ✓
B. They preserve vector norms. ✓
C. They are always square matrices. ✓
D. Their determinant is always zero.

Which of the following vectors is orthogonal to \(\begin{matrix} 1 \\ 2 \end{matrix}\)?

A. \(\begin{matrix} 2 \\ 1 \end{matrix}\)
B. \(\begin{matrix} -2 \\ 1 \end{matrix}\) ✓
C. \(\begin{matrix} 1 \\ -2 \end{matrix}\)
D. \(\begin{matrix} 0 \\ 0 \end{matrix}\)

Which of the following are methods to solve a system of linear equations?

A. Gaussian elimination ✓
B. Matrix inversion ✓
C. Cross product
D. Substitution method ✓